

## EFFECT OF NITROGEN AND PHOSPHORUS ON SUNFLOWER SEED YIELD UNDER RAINFED CONDITIONS

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A study was conducted under the All India Co-ordinated Research Project on Dry-land Agriculture, Gujarat Agricultural University, Anand Campus Anand during *Kharif* and *rabi* seasons of 1974-75 with four levels of nitrogen (0, 15, 30, and 45 kg/ha) and four levels of  $P_2O_5$  (0, 30, 60, and 90 kg/ha) to find out optimum dose of N and  $P_2O_5$  for sunflower under rainfed conditions. The results indicated that Nitrogen application upto 30 kg N/ha increased yield and higher levels of N did not result in further increase in yield, on the otherhand it affected yields adversely. Application of 30 kg N per hectare also appeared to be the economical level for sunflower crop.

In sunflower, the grain can be considerably increased under rainfed conditions if suitable agronomic practices are adopted. Sunflower is a heavy feeder (Rollier, 1970). Availability of certain plant nutrients in the soil affect yield and growth of sunflower crop. Besides, it also affects its tolerance to certain plant diseases (Saric *et al*, 1972). Oil content in the sunflower seed is also affected by changes in the proportion of Nitrogen, phosphorus and K in the soil (Bamdad 1972). Therefore, a study was conducted to determine the optimum requirements of N and  $P_2O_5$  for sunflower variety EC 68414 under rainfed conditions of Gujarat.

### MATERIAL AND METHODS

The experiment was conducted on sandy loam soil. The soil had a pH

of 7.5 and 0.8 per cent organic matter. It was low in nitrogen and high in phosphorus and potash. The treatments consisted of 4 levels of nitrogen (0, 15, 30 and 45 kg/ha) and 4 levels of  $P_2O_5$  (0, 30, 60 and 90 kg/ha). The design of the experiment was R.B.D. with four replications. The experiment was taken in *Kharif* and *rabi* seasons of 1974-75 with a net plot size of 4.8 X 3.0 m. and 3.6 X 1.25 m respectively. The seeds were dibbled at a distance of 60 cm between rows and 20 cm between plants.

The crop was thinned a fortnight after sowing keeping one plant per hill. The N as urea and  $P_2O_5$  as single super phosphate treatments were applied as basal in open furrows at a distance of 60 cm apart before sowing.

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## RESULTS AND DISCUSSION

The total rainfall of the season (May to October 1974) 344.5 mm was received in 24 in days and was considerably less than half of the average rainfall of 815 mm of the area. However rainfall useful to the crop was only 309.75 mm in 22 days. As the distribution of rainfall was not uniform, the crop was adversely affected leading to poor harvest during *Kharif* season

Data on seed yield and other attributes as affected by levels of nitrogen and P<sub>2</sub>O<sub>5</sub> are presented in Tables 1 and 2 respectively.

### Effect of Nitrogen :

**Seed Yield :** The effect of nitrogen on seed yield was significant in both the seasons. There was an increasing trend in seed yield with increase in dose of nitrogen upto 30 kg/ha. However, with further increase in the dose of nitrogen there was decline in yield. These results are in conformity with the findings of Singh *et al.* (1977) who reported that nitrogen upto 60kg/ha increased seed yield of rainfed sunflower. Application of nitrogen beyond 60 kg/ha had no effect on yield level. In the present study seed yield was significantly increased with the application of 30 kg N/ha over control and 15 kg N/ha in both the seasons. Nitrogen application at 30 kg/ha gave a response of 6.1 kg and 3.2 kg seed per kg of N in *rabi* and *Kharif* respectively. Higher response to nitrogen application in *rabi* season may be due to higher proportion of

matured seeds obtained as a result of low atmospheric temperatures and high insect pollination. Singh (1975) also reported that insect activity under hot conditions was very limited and if this coincides with soil moisture shortage it inevitably resulted, in poor seed setting and low oil content in the seed. In the present study in *rabi* season the temperature was low (30°C) at the time of seed setting which resulted in increased number of good seeds per flower head compared to that in the *Kharif* season (Table 2), when the atmospheric temperature was high (33°C). Higher seed yield with increased levels of nitrogen upto 30 Kg can be further attributed to the favourable effect of nitrogen on the diameter of the flower head, number of filled seed per flower head and leaf area which ultimately contributed to the increase in seed yield.

**Oil content and oil yield:** Oil content is an important quality attribute of any oil crop. In the present study higher levels of N application significantly reduced oil content of sunflower in both the seasons. These findings are in conformity with those of Zubri-ski and Zimmerman (1974). Singh *et al.*, (1977) also noted that increased levels of nitrogen application decreased oil content in sunflower seed. There was a progressive and significant decrease in oil content in the seed with the application of higher levels of N over control. But total oil yield increased with increase in nitrogen upto 30Kg/ha. This was due to increase (32.5%) in seed yield of sunflower as compared

to smaller reduction (5.5%) in oil content of the seed.

#### Yield Attributes :

**Plant height:** The effect of different levels of nitrogen application on plant height was significant in *rabi* season alone (Table 2). Nitrogen application at 45 Kg/ha recorded highest plant height (109.31 cm) which was 5.7 per cent more than control (103.31 cm).

**Diameter of flower head:** Diameter of flower head increased significantly with nitrogen application upto 30 Kg/ha in *rabi* season, (Table 2). However, with further increase in the level of nitrogen there was no change in the size of the flower head. Massey (1971) observed that nitrogen application 56 Kg/ha increased head diameter of sunflower by 2.2 cm as compared to non-treated plots. There was no further increase from additional nitrogen application.

**Number filled seeds per head :** Number of filled seeds per head were not affected significantly by levels of nitrogen in *Kharif* season. However, in *rabi* season there was significant increase in number of filled seeds per head with the increasing levels of nitrogen upto 30Kg per hectare (Table 2.) However, further increase in the nitrogen dose (45 Kg/ha) had an adverse effect on the number of filled seeds per head

#### Effect of Phosphorus :

Phosphorus had no significant effect on seed yield and other yield attributes in both the seasons. The probable reason for this may be high initial  $P_2O_5$  content of the soil under

study (1.75 mg/gm soil). Singh *et al.*, (1977) had also found that  $P_2O_5$  had little effect on the seed yield of sunflower.

From the above discussion it is evident that application of 30 Kg nitrogen per hectare is effective and economical and gave the highest seed yield of 413 Kg/ha. However the application of nitrogen fertilizer to sunflower crop is more remunerative in *rabi* season as compared to *Kharif* as response of one Kg nitrogen was more in *rabi* (5.1 Kg seed/Kg of nitrogen) than in *Kharif* season (2.1 Kg seed/Kg of nitrogen)

#### REFERENCES

- BAMDAD, D. J. 1972. Effect of NPK ratio and application rate on sunflower seed yield and other characteristics. 5<sup>th</sup> conference international sur le TOURENSOL 25-29 Juillet.
- MASSEY, J. H. 1971. Effect of nitrogen rate and plant spacing on sunflower seed yields and other characteristics. *Agron. J.*, 63: 137-8
- ROLLIER MICHEL. 1970. The variety factor which affect the quantity and quality of sunflower proteins. Concetence by Jean Guy PIERRE, Laboratoire Biologic CETIOM.
- SARIC, M., B JOCIC and VERESBARANJ I. 1972. The investigations of the effect of different dose and ratios of NPK minerar fertiilizers on seed and oil yield of sunflower. 5<sup>th</sup> conference international sur le TOURNESOL 25-9 Juillet.
- SINGH, S. S. 1975. Pick your sunflower varieties, *Intensive Agri.* 13 :10-11,
- SINGH, P. P., Y.K. SHARMA, and P.K. KAUSHAL. 1973. Effect of levels of nitrogen and phosphorus on yield, and quality of sunflower. *JNKVV Res J.*, 7: 134-6
- SINGH, R.A., O. P. SINGH H. C. SHARMA, and M. SINGH 1977. Effect of levels of nitrogen and phosphorus on yield, oil content and moisture use pattern of rainfed winter sunflower. *Indian J. Agri. Sci.*, 47: 96-9
- ZUBRISKI, J. C. and D. C. ZIMMERMEN, 1974. Effect of nitrogen phosphorus and plant density in sunflower *Agron. J.* 66 : 798-80.

Table 1 Effect of nitrogen and phosphorus on seed yield, oil content and oil yield of Sunflower during 1974.

Treatment	Seed Yield Kg/ha			Oil content %			Oil Yield Kg/ha		
	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled
Levels of N (Kg/ha)									
0	289	258	273	39.7	42.6	41.2	114	109	111
15	306	318	312	38.8	38.5	38.6	118	123	120
30	385	440	413	38.1	40.0	39.0	145	178	161
45	281	305	323	34.9	38.0	36.5	96	140	118
C. D. 0.05	51	75	48	3.4	2.5	2.0	18	33	20
Levels of P (Kg/ha)									
0	272	325	299	38.2	40.9	39.6	105	130	118
30	329	348	339	38.9	39.9	39.4	126	139	133
60	304	363	361	36.5	38.9	37.7	122	142	129
90	319	346	332	37.7	39.4	38.6	120	138	129
C. D. 0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS
C. V. %	19.7	30.5	14.8	10.72	7.7	5.2	25.3	25.3	15.8

Interaction not significant for all characters.

Table 2 Effect of nitrogen and phosphorus on yield attributes of EC 68414.

Treatment	Plant height cm			Diameter of head cm			Filled seed per head		
	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled	Kharif	Rabi	Pooled
Levels of N (Kg/ha)									
0	87.5	103	95.5	6.6	9.2	7.9	146	209	177.5
15	89.4	102	95.8	6.7	9.1	7.9	172	244	208
30	92.5	106	99.3	7.1	10.3	8.7	177	319	248
45	86.1	109	97.6	6.7	10.4	8.6	152	268	210
C. D. 0.05	NS	5	NS	NS	0.78	NS	NS	43	NS
Levels of P (Kg/ha)									
0	82.2	102	92.2	6.2	9.6	7.9	132	243	187.5
30	92.7	108	100.7	7.2	9.5	8.4	178	244	211
60	90.9	105	98.4	6.8	9.3	8.1	180	258	219
90	89.6	104	97	6.9	10.2	8.6	157	275	216
C. D. 0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS
C. V. %	12.48	7	10.2	16.09	11.21	8.5	39.71	27.23	23.5

Interaction not significant for all characters.